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FREQUENCY MANAGEMENT DATABASE MODEL (FMDM) FOR THE KOREAN ARMY COMMUNICATION SYSTEM AT THE REGIMENT UNIT LEVEL

by

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March, 1989

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A signal officer in the ROKA can use the FMDM for the allocation, planning, and distribution of radio frequencies, in order to achieve the optimum use of the frequency spectrum.

A discussion of security has been included in this thesis so that both the hardware and software of the FMDM are protected..

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Frequency Management Database Model
(FMDM) for the Korean Army
Communication System at the
Regiment Unit Level

by

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ABSTRACT

This thesis provides a Frequency Management Database Model (FMDM) for the Republic of Korean Army (ROKA) Communication System. The FMDM uses a personal computer to increase the efficiency of the frequency management system at the regiment unit level in the Korean Army.

A signal officer in the ROKA can use the FMDM for the allocation, planning, and distribution of radio frequencies, in order to achieve the optimum use of the frequency spectrum.

A discussion of security has been included in this thesis so that both the hardware and software of the FMDM are protected.

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I. INTRODUCTION

A. BACKGROUND

A communication system is very important in government, national defense, and civilian organizations. An effective and efficient communication system is essential to all countries in the world, including the Republic of Korea (ROK). After World War II the Korean Peninsula was divided into two parts: South Korea (the Republic of Korea) and North Korea. North Korea had a very powerful military force and an aggressive attitude during the separation period. In order to defend itself, South Korea increased the size of its military force.

Each of the South Korean military forces, Army, Navy, and Air Force, have their own communication system and operate them separately to support their forces.

B. PURPOSE

The purpose of this thesis is to develop a Frequency Management Database Model (FMDM) to give effective guidance to the signal officer at the regiment unit level in Korean Army Communication System (KACS). This includes all aspects of the Communications Electronics Operation Instruction (CEOI) and the requirements for communications in the specific area of frequency management. This database will include the allocation, planning, and distribution of radio

frequencies, in order to achieve the optimum use of the frequency spectrum.

> The CEOI provides for regular (one or two times a month) and simultaneous changes of radio call signs, suffixes, and frequencies which come from the Chief of Communication Headquarters. The distribution of the CEOI is limited to those units and individuals who have a requirement to use them.
>
> The signal officer makes this decision and determines the distribution of the CEOI within their units. He then distributes the CEOI extracts required by their commands or units.
>
> Normally, Korean Army units have two types of CEOI material: a Training CEOI and an Operational/Reserve CEOI. [Ref.1: p.3-4].

The primary purpose of communications is to serve command. In this role, communications are the instrument by which a commander makes his desire or will known and therefore is termed the "voice of command." Communications permit the commander to exert personal influence in the exercise of command and control of assigned forces, supporting fires, and combat service support over large areas than would otherwise be impossible. Any transmission speaks only for and with the authority of the commander who originated the transmission.

The secondary purpose of communications is to facilitate the transfer of information between individuals and groups which is necessary in the exercise of command. [Ref.2: p.1-1].

C. SCOPE

This thesis will describe the current problems in the Korean Army Communication System regarding the CEOI,identify the concept of frequency management, and develop the requirements for future communications in the specific area of frequency management.

This thesis will also develop a Frequency Management Database Model (FMDM) at the regiment level of the Korean Army for the allocation, planning, and distribution of frequencies in order to achieve the optimum selection. The author's military experience and knowledge will be used in developing the database model.

The author will not cover any classified aspect within the KACS, and therefore, will assume all units, call signs, suffixes, radio equipment, and frequencies.

D. ORGANIZATION

This thesis contains five chapters. Chapter I provides a brief introduction including definition, purpose, and outline. Chapter II provides a brief introduction, problems, and requirements of the KACS. In Chapter III, the basic concept of frequency management is discussed. The FMDM is developed and discussed in Chapter IV, the main chapter of this thesis. Finally, all conclusions and anticipated problems are discussed in Chapter V.

II. KOREAN ARMY COMMUNICATION SYSTEM

A. BACKGROUND

After World War II, on August 15, 1945, Korea was liberated from the 35-year colonial rule of the Japanese. But the liberation did not turn out the way most Koreans had hoped it would. After the Yalta Agreement, Korea was divided into two areas at the 38th Parallel North Latitude. The northern area became North Korea and the southern area became South Korea or the Republic of Korea.

At that time, many young military men who had gained military experience when they were in the mainland of China or in Japan came back to their Korean homeland after the end of World War II. They began organizing private military groups or semi-military groups upon the pretext of maintaining the Republic of Korea (ROK) sovereign rights and for protecting its national security.

At first, the defense for the ROK was composed of two main bureaus, a military bureau and a police bureau. On April, 9, 1946, the two bureaus were separated completely. The members of the military bureau began to work only for the creation and development of the ROK Army.

Unfortunately, however, the Republic of Korea fought a fratricidal war (the Korean War) with North Korea from 1950 to 1953. During the first phase of the Korean War, South

Korea was almost defeated because its military forces were inferior to the North Korean forces. However, with the assistance of the United States Forces (USF) and the United nations Forces (UNF), the Republic of Korea was saved during this great crisis.

As a result of the Korean War, the Republic of Korea increased the size of its military forces, modernized its military equipment, and had well organized units to protect the whole nation.

B. PRESENT KOREAN ARMY COMMUNICATION SYSTEM

The communication system of Korea has existed for over one hundred years. The modern postal system was introduced in 1884 and the first telegraph service in 1885. The whole development process of the country's communications may be divided into three stages.

The first stage, from 1885 to 1961, may be termed as the period of stagnation which was characterized by negligible progress in communication development due to the two World Wars and the Korean War. The following stage, from 1962 to 1981, was the period of planned development for modernization of communication facilities, including coaxial cables and microwave systems, when remarkable progress was made in parallel with national economic development. The final stage, from 1982 to the present, can be called the period of intensified development in preparation for the emergence of the information society

which includes fiber optic cables, digitization of communication media, and satellites. [Ref.2:p.5]

After the cease fire of the Korean War, which was signed in 1953, the ROK Army has developed its own tactical communication system at the division and corps unit level. The experience of warfare focused attention on the vital importance of communications in determining the success or the failure of combat operations.

Before the 1970's, KACS used the same radio equipment, coaxial cables, and microwave systems which were used by the United States Army (USA) during the Korean War. However, after the mid-1970's, the KACS has used domestic made communication equipment to enhance the effectiveness of the ROK Army Operations. Below the division unit level, the KACS uses FM and AM radio equipment and coaxial cables. At the division and corps unit level, VHF radio and teletype equipment are used. A microwave communication system is used above the corps unit level. These systems are similar to US Army communication systems.

C. PROBLEMS AND REQUIREMENTS

The ROK Army uses a communication system to support its military units in routine activities and combat operations. Currently the frequency management portion of these communication systems is developed and distributed by a CEOI (Communications Electronics Operation Instruction). The CEOI is manually distributed from the Signal

Headquarters to the subunits in the field. The CEOI contains, among other things, the frequency assignments for specific radio networks which will be used during all military operations and exercises. The development, organization, and distribution of the CEOI requires a great deal of time since it is done by individuals without the aid of any automation.

This thesis will show how the Korean Army Communication System can be improved by using a personal computer (PC) to increase the effectiveness, management, distribution, and survibility of the system in the frequency management area and in particular with the CEOI. This personal computer system will include a hard disk to keep all the data which contain unit codes, frequencies, call signs, and specific codes. The CEOI can then be distributed to all subunits by means of a floppy diskette. This system will also provide a greater degree of security for the communicator who can easily destroy all information in an emergency situation.

III. BASIC CONCEPT OF FREQUENCY MANAGEMENT

A. INTRODUCTION

The radio frequency spectrum is a manmade natural resource. The usable spectrum is limited only by man's ability to technologically employ radio frequencies. The radio frequency spectrum is finite and is not exhausted through use and does not become worn out. As with other natural resources, careless use can pollute it and prevent the extracting of maximum benefit from the spectrum.

This chapter presents a discussion of the structure of radio frequency spectrum management within the ROK from a military perspective.

The management of the spectrum is divided into three major levels: the International Level, the National Level with Non Military, and the National Level with Military. Figure 1 shows an overview of these three levels of the frequency management hierarchy. This figure indicates the relation of the International Telecommunication Union (ITU) which is under the United Nations (UN), and the Ministry of Communications (MOC), and Ministry of National Defense (MOND) which are under the Korean Government Organization. These lines do not indicate control within the hierarchy, but the flow of recommendations to and from the international forum for the purpose of radio frequency

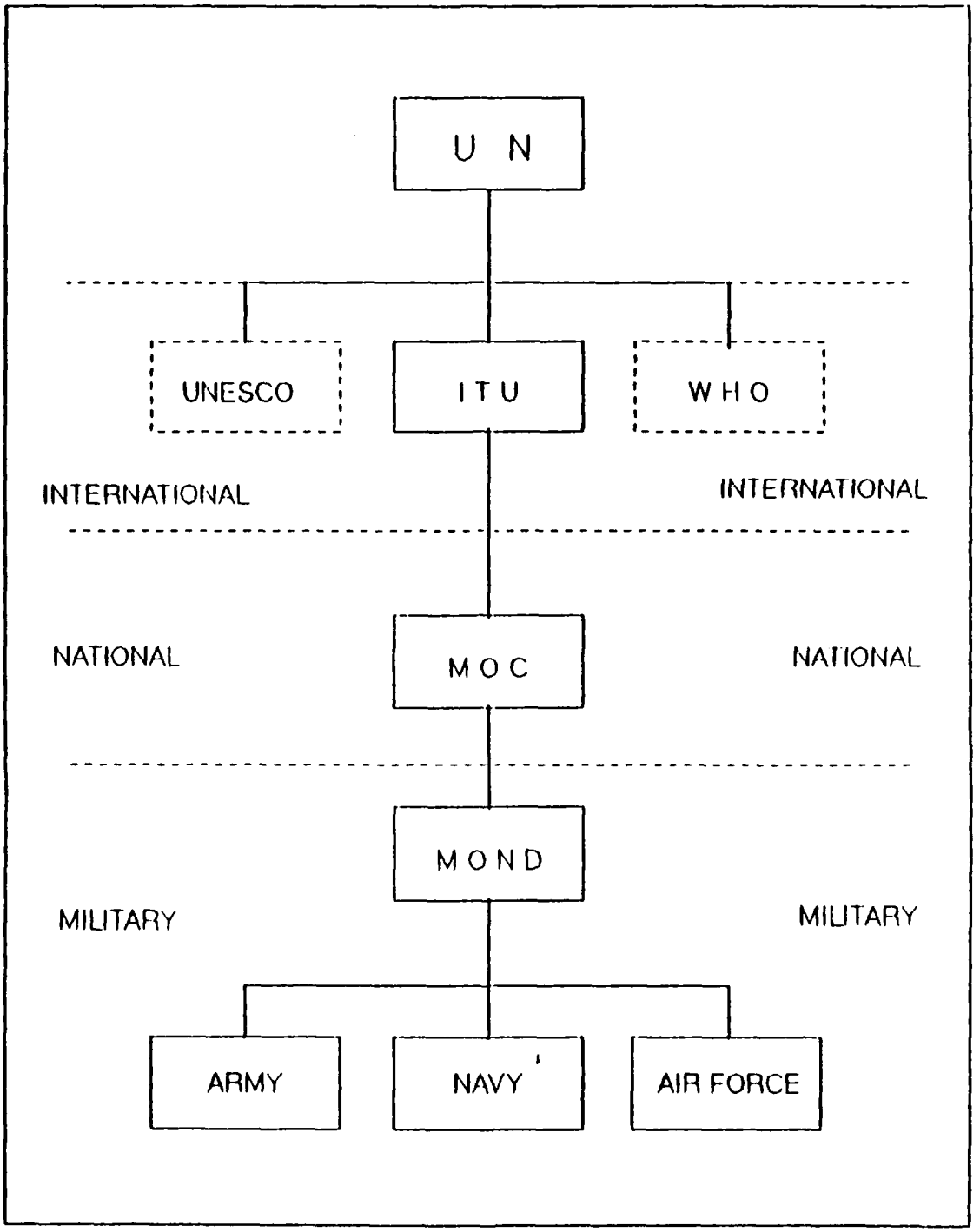

Figure 1. Frequency Management Hierarchy : Overview

spectrum management (this term will be defined later). The lines between the MOND and military services are indicative of a control function in spectrum management.[Ref.4:p.22E]

B. GENERAL CONCEPT of FREQUENCY MANAGEMENT

In this chapter, the author will discuss international regulation, the international level organization, (ITU), and frequency allocation by geographical divisions of the frequency management.

1. International Regulation

Since electromagnetic waves have no respect for geopolitical or geographical boundaries, an international understanding and cooperation on allocation and use of the radio frequency spectrum is required. National plans must be tailored to conform to the international regulations.

The necessity for international agreements on spectrum allocation can be illustrated by some examples. Pilots of aircraft on international flights must be able to communicate at all times with at least one check point along each route. Thus, for the purpose of safety, flight control and navigation equipment for aircraft must be compatible with any other communications-electronics equipment that may be encountered during a flight. Even if not strictly required, it is often advantageous to have a high degree of international standardization.

For the military, even during wartime, unrestricted spectrum utilization can not be allowed since various

countries have allies with whom they must cooperate. Additionally, during wartime certain civil safety services can be as important as during peacetime and will require continued protection. [Ref.5:p.13]

2. International Telecommunications Union (ITU)

International allocations of the radio frequency spectrum and registration of frequency assignments are accomplished by the ITU. The ITU finds its origins in two predecessor associations, the International Telegraph Union which was created in 1865 with 20 member nations, and the International Radio-telegraph Union which was founded in 1906. These two organizations combined in 1932 to form the ITU.

The ITU is now a specialized agency of the United Nations (UN) and has membership of more than 150 countries. The major material outputs of the ITU are international radio regulations which govern international telecommunications. The ITU Headquarters are located in Geneva, Switzerland, where a permanent secretariat is supported by member nations. [Ref.6:p.1]

The ITU is composed of several permanent groups: the Administrative Council, the World Administrative Telegraph and Telephone Conference (WATTC), the World Administrative Radio Conference (WARC), the General Secretariat, the International Telegraph and Telephone Consultative Committee (CCITT), the International Radio

Consultative Committee (CCIR), and the International Frequency Registration Board (IFRB). The General Secretariat is under the Administrative Council, CCITT is under the WATTC, and CCIR and IFRB are under the WARC. Figure 2 shows the structure of the ITU and its organizations. The author will explain briefly the two major radio frequency groups: CCIR and IFRB. [Ref.6:p.478]

a. The International Radio Consultative Committee

The CCIR studies technical and operational questions relating to the use of radio in general and issues reports and recommendations on operational procedures. A number of study groups deal with specific phases of radio communications, such as spectrum utilization and monitoring, fixed multichannel radio systems, wave propagation, space systems and radio astronomy, broadcasting, and mobile communication systems.

Plenary assemblies of the CCIR normally are held every three years to update, correlate, and approve the workdone in the intervening period by the study groups. The study groups usually work through national committees and hold international interim meetings between plenary assemblies. The output of a CCIR plenary assembly may consist of a report supporting a specific recommendation, a partial report calling for further study, or a report introducing a specific study program.

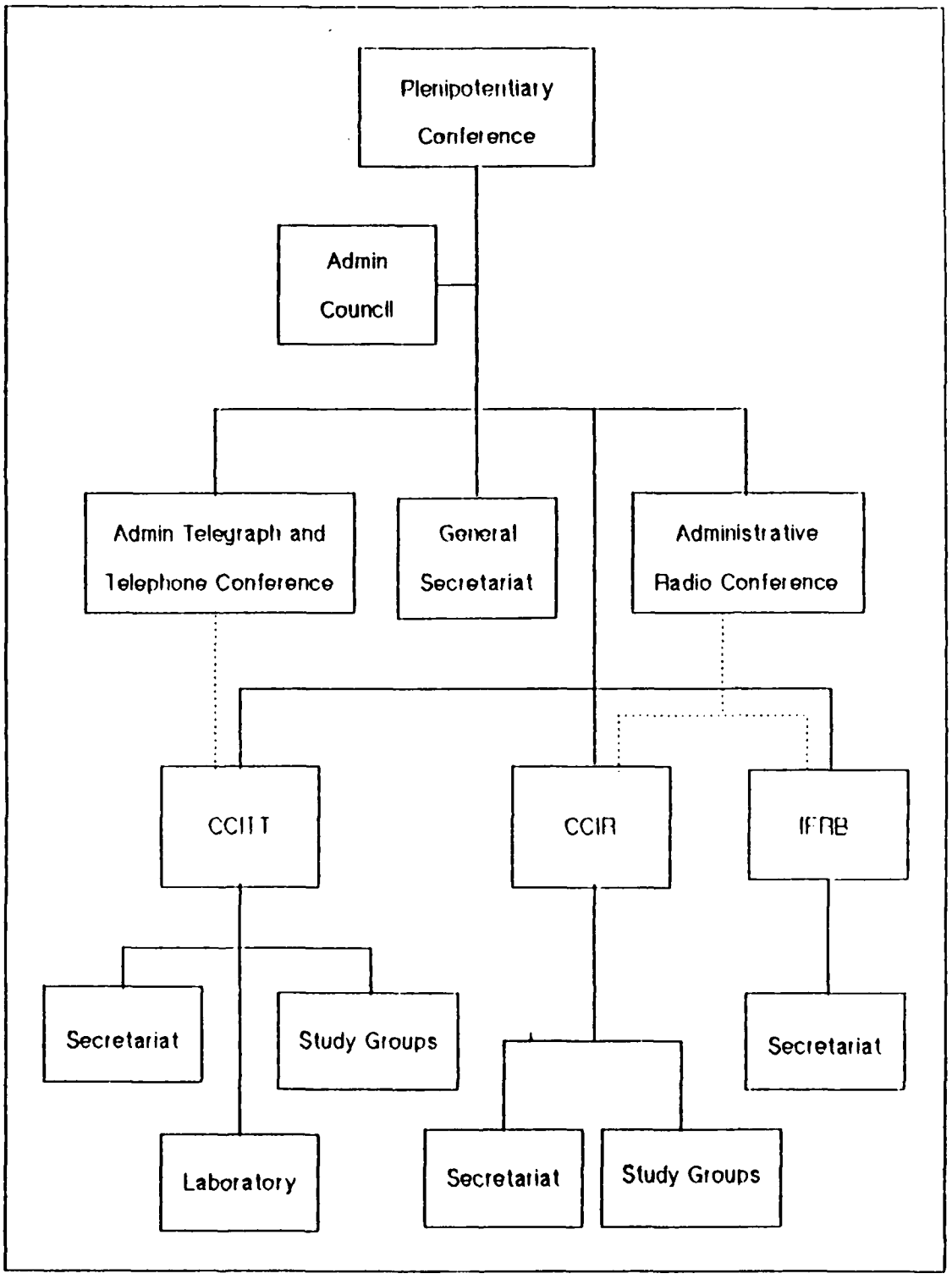

Figure 2. ITU Organization Structure

In any event, the CCIR does not dictate standards by itself, but rather recommends "preferred characteristics" which, in large measure, constitute the technical bases for actions of the ITU Administrative Radio Conferences. [Ref.6:p.121]

b. The International Frequency Registration Board

The IFRB of the ITU is an elected five member board which has two major functions:

(1) maintaining an international register of approved frequency assignments, which shows the registration date, purpose, and technical characteristics of each assignment, and

(2) furnishing advice on the maximum practicable number of channels in a band to ensure optimum utilization of the radio frequency spectrum capacity.

The date of registration with the IFRB for any frequency assignment is an important factor in the relative position of that assignment on the priority list in the resolution of any subsequent interference. [Ref.6:p.241]

3. Geographical Divisions

For the purpose of frequency spectrum allocation, the ITU divides the world into three major regions. Figure 3 shows the current ITU regions. Region 1 includes Europe and Africa, Region 2 includes North and South America and the Northern Pacific. The Korean Peninsular is located in ITU Region 3. [Ref.8:p.R5-28]

Frequency allocation involves the administrative division of the radio frequency spectrum into bands, and

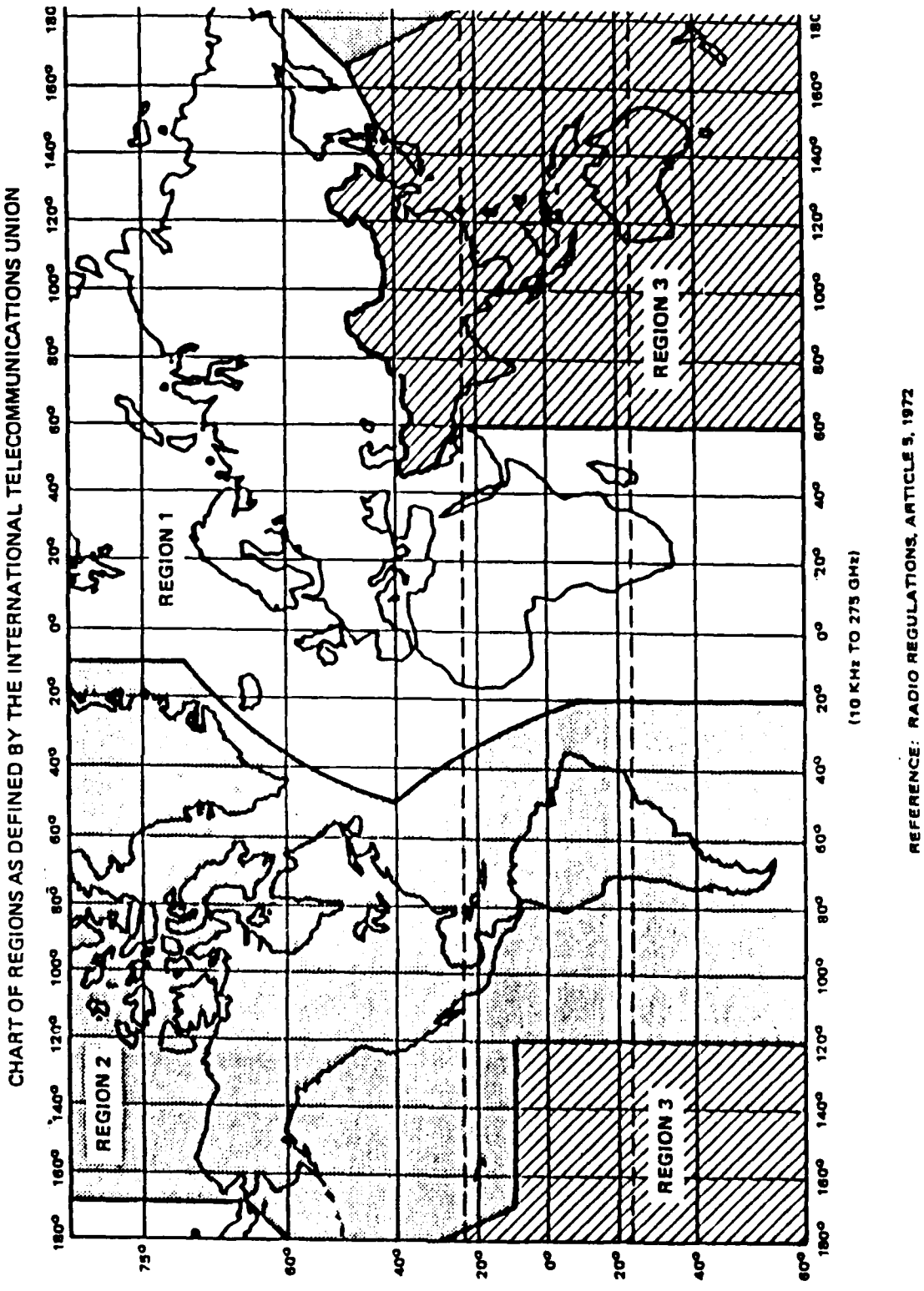

Figure 3. ITU Allocation Regions

the classification of spectrum-using operations (communications, radiolocation, etc.) into groups called services. These frequency bands are assigned to specific services on either a worldwide or regional basis. A typical service may be the same in all three regions, or it may vary among the regions in accordance with international agreement. Thus, communications equipment are designed technically and functionally to operate in one area of the world may not be authorized for use in another area.

All services that share allocated bands, either worldwide or regionally, are listed in the ITU Table of Frequency Allocations by priority: primary services, permitted services, and secondary services. By international agreement, the usable radio frequency spectrum was sub-divided into a number of discrete frequency bands. Each of these bands was, in turn, allocated to one or more of the several recognized categories of radio services such as fixed, mobile, and broadcasting.

Table 1 and Table 2 show the type of information which is contained on pages of the ITU Allocation Table from Radio Regulations which apply to the 174-235 MHz band [Ref.8:p.RR5-54] and 335.4-401 MHz band [Ref.8:p.RR5-59]. The tables are arranged by frequency band, usage, and priority of rights. The usage is implied by service category which is fixed, mobile, broadcasting,

TABLE 1. ITU ALLOCATION TABLE : 174 - 235 MHZ

<table>
<tr><th colspan="3">ALLOCATION to SERVICES</th></tr>
<tr><th>REGION 1</th><th>REGION 2</th><th>REGION 3</th></tr>
<tr><td>174 - 216

Broadcasting</td><td colspan="2">174 - 216

Fixed

Mobile

Broadcasting</td></tr>
<tr><td rowspan="2">216 - 223

Aeronautical
Radionavigation

Broadcasting</td><td>216 - 220

Fixed

Mobile
Radiolocation</td><td rowspan="2">216 - 225

Aeronautical
Radionavigation

Radiolocation</td></tr>
<tr><td rowspan="2">220 - 225

Amateur

Radiolocation</td></tr>
<tr><td rowspan="2">223 - 235

Aeronautical
Radionavigation

Fixed

Mobile</td><td rowspan="2">225 - 235

Fixed

Mobile</td><td rowspan="2">225 - 235

Fixed

Mobile</td></tr>
</table>

TABLE 2. ITU ALLOCATION TABLE : 335.4 - 401 MHZ

ALLOCATION to SERVICES		
REGION 1	REGION 2	REGION 3
335.4 - 399.9	Fixed Mobile	
399.9 - 400.05	Radionavigation - Satellite	
400.05 - 400.15	Standard Frequency - Satellite	
400.15 - 401	Meteorological Aids Meteorological - Satellite Space Research	

radiolocation, satellite, and so forth. In these examples, the Korean Peninsula can use fixed, mobile, and broadcasting at 174-216 MHz, aeronautical radionavigation and radiolocation at 216-225 MHz, and fixed, mobile, and aeronautical radionavigation at 225-235 MHz. The Korean Peninsula can use frequencies within the 335.4-401 MHz band as shown for Region 3 in Table 2. All priority of rights for individual nations are explained for each band at bottom of the actual ITU tables.

C. DEFINITION OF MANAGEMENT TERMS

The term management, used in this sense, is the attempt to control the utilization of the spectrum in order to obtain the greatest benefit for the greatest number of people. Radio frequency spectrum management concerns itself with the control of the spectrum resources. This involves the following managerial activities:

(1) formulating plans for the use of the spectrum and executing controls over users of the spectrum,

(2) structuring tasks for management of the spectrum and making decisions about managing the spectrum,

(3) communicating information and policy about decisions concerning frequency management,

(4) dealing with conflicts over how the spectrum is to be used and by whom,

(5) maintaining stability in spectrum management practices,

(6) controlling change activities in spectrum management, and

(7) apportioning resources among competing needs.

The two important aspects of resource apportionment are frequency allocation and frequency assignment.

In essence, the real task of radio frequency spectrum management is the allocation and assignment of radio frequencies that minimize harmful interference while providing telecommunication services at the lowest possible cost. A major function of spectrum management is to decrease the growing congestion in the spectrum which leads to mutual interference. At the same time it must provide effective, rapid, and reliable telecommunication services.

There is a distinction between frequency allocation and frequency assignment although some sources use the terms interchangeably. Frequency allocations are made at the international level while frequency assignments are made by individual nations. The frequency assignments are designed to be made in accordance with a national frequency allocation plan which is a subset of the international frequency allocation plan. [Ref.7:p.11]

1. Frequency Allocation

This term is applied to the process of setting aside certain frequency bands to perform selected functions or to support certain radio services. Frequency allocation may be thought of in two ways. First, frequency allocation may be viewed as the designation of a band of frequencies to a specific telecommunication service. This view of allocation implies the existence of no specific spectrum user or

constraint of particular frequencies to a particular geographic area. Second, frequency allocation may be viewed as the designation of a band of frequencies and a specific service application to a given user or particular geographic area.

This is examplified by allocation of electromagnetic spectrum resources; the designation or distribution of electromagnetic spectrum channels or band for a type of communications-electronics service, for example, fixed broadcasting system, amateur radio communications, aeronautical radionavigation, maritime mobile and mobile communications, or radio station; and approval of communications-electronics equipment during the design phase with respect to the specification of design standards, operational restrictions, including geographical areas, and designation or approval of tuning limits to ensure that operations will be within the bands established for the intended type of service. [Ref.7:p.11]

2. Frequency Allotment

This is a further subdivision of allocation to a service. Frequency allotment is the distribution of electromagnetic spectrum channels or bands to support operations for a type of service within specified areas or countries.

3. Frequency Assignment

The frequency assignment is defined as the designation of a specific frequency within an allocation for a specific user of communications-electronics equipment. This implies some property rights to the user of that frequency to the mutual exclusion of other users.

A frequency assignment specifies not only the assigned (center) frequency but also the size of the spectrum segment required. Emission bandwidth describes the size of the spectrum segment required for a specific frequency assignment. Thus, a frequency assignment centered at 20.00 megahertz with an emission bandwidth of 10 kilohertz would employ frequencies ranging from 19.995 to 20.005 megahertz. The emission bandwidth requirements for various items of communications-electronics equipment may vary from a few hertz to several million hertz.[Ref.7:p.12]

D. ELECTROMAGNETIC SPECTRUM MANAGEMENT

1. Background

The electromagnetic spectrum is an array of all types of electromagnetic radiation arranged on the basis of their frequencies, spectral densities, and spacial volumes. Many types of radiation, such as sunlight, x-rays, broadcasting waves, and microwaves are encountered in everyday life. Many types of radiation are seemingly different in form and do differ in terms of frequency or wavelengths. Even though not identical, they obey the some

natural and physical laws, and their velocities of propagation in free space are identical. This velocity is that of light.

2. Basic Theory of Electromagnetic Spectrum

The electromagnetic spectrum or more specifically the radio frequency spectrum represents a vital and intangible national resource. It is a limited resource because only a small portion of the spectrum can be used for any given purpose within the bounds of present technology. Each radio operation requires a finite part of the spectrum, a channel, in the time and geographical domains.

The electromagnetic radiation may be visualized as a form of wave motion with wavelength or frequency as the important parameter. Wavelength is the distance between two consecutive peaks in the unmodulated wave. Frequency is the number of waves passing a fixed point per unit time interval. In a discussion of radio communications, frequencies are more commonly used than wavelengths. Hertz is the unit of measure of radio frequency. One Hertz is one cycle per second. The Hertz is named after Heinrich Rudolph Hertz, German physicist (1857-1894), who discovered electromagnetic radiation.

The order of electromagnetic radiation within the spectrum, arranged by increasing frequency, is from low audio frequencies (long wavelength) through radio frequencies, infrared, visible light, ultraviolet, and x-rays to high gamma radiation (short wavelength). The radio frequency spectrum is that portion of the electromagnetic spectrum with radiations whose frequencies range from 3 KHz to 3000 GHz. However, the frequency band from 300 GHz to 3000 GHz is beyond the limits of the current usable spectrum for the purpose of communications-electronics frequency management. Figure 4 shows the division of the managed radio frequency spectrum. [Ref.4:p.15-E]

Frequency Range	Band Code	Wave-length	Typical uses
Below 3KHz	ELF	100 Km	Very long distance comm Point-to-point comm
3-30 KHz	VLF	10 Km	Very long distance comm Point-to-point comm Fleet broadcast comm
30-300 KHz	LF	1 Km	Long distance, Marine comm Point-to-point comm Navigation Aids
300-3000KHz	MF	100 m	Broadcasting, Marine comm Harbor telephone, NavAids
3-30 MHz	HF	10 m	Moderate and long distance communications of all type
30-300 MHz	VHF	1 m	Short distance comm TV and FM Broadcasting Navigation Aids
300-3000MHz	UHF	10 cm	Short distance comm Radar, TV broadcasting Aero-Navigation-Aids
3-30 GHz	SHF	1 cm	Short/Long distance comm Radar, Satellite comm Relay system, Nav Aids
30-300 GHz	EHF	0.1cm	Radar communication Radio-Relay-Nav Aids

Figure 4 Managed Radio Frequency Spectrum

IV. DATABASE MODELING AND ANALYSIS

A. BACKGROUND

This chapter presents a study of the proposed database model for the ROK Army signal units. All information for the frequency distributions, such as, frequencies for radio equipment, call signs, channel numbers, and name of units will be assumed. All terms will be similar to the Korean language style. The proposed database model will be developed to increase the benefits of frequency allocation and distribution using computer aids. This model will help signal officers at the regiment unit of ROKA save time and also provide better frequency structures and report formats.

There are two types of radio equipment at the Regiment level which are used for the radio telecommunication networks. They are AM radios and FM radios.

AM radio equipment operates on less than eight frequencies. These are both the main operating frequencies and reserve frequencies. These frequencies are used between the Regiment unit level and Battalion units for Command 1 and Command 2. Command 1 is the "Command Network of the Regiment" and Command 2 is the "Support Network Of the Regiment". The channel numbers vary from 0000 to 9999

and the frequencies vary from 1.00 MHz to 20.00 MHz. The interval of frequencies is 0.01 MHz.

For FM radio equipment, there are more than forty frequencies for main operating and reserve use. These frequencies are operated between the Regiment unit and Battalion units and also between the Regiment unit and certain Company units. The channel numbers vary from 0000 to 9999 and the frequencies vary from 20.00 MHz to 100.00 MHz. The interval of the frequencies is 0.05 MHz.

B. DESIGN

1. Data Structures

The small number of data elements used in developing the desired program exist between many combinations of the elements. In order to illustrate, a logical database will be constructed in which all relations are normalized to Third Normal Form (3NF) and inherent operational problems of a normalized form as well as anomalies resulting from an unnormalized form will be considered. [Ref.9:p.142-44]

a. The Frequency Relation

The frequency relation is composed of several data elements related to frequency allocations. The following attributes will be considered initially:

F I C	Frequency Identification Code
Channel	Channel Number of Equipment
Frequency	Frequency of Equipment
Call_Sign	Special Code of Unit
Prob_Code	Special Problem of Frequency
Use_Code	Status of Frequency
Unit_Code	Status of Loaded Frequency

The FIC has one character and contains two items which are "A" and "F". "A" stands for AM radio frequency and "F" stands for FM. The Channel has four numerical numbers and gives the specific meaning of the real frequency of the radio equipment. The Frequency has six numerical digits with two decimals and shows the real frequency of the radio equipment. The Call_Sign has ten characters and expresses the special code of the radio equipment at the unit. The Prob_code has one character and contains four special codes which are "T", "H", "U", and "W". The "T" stands for "Terrain problem" which means that some frequencies can not transmit in mountain areas. The "H" stands for "Harmonic problem" and means some odd harmonic frequencies can jam each other. The "U" stands for "Useful frequency" which means any unit can use this frequency. The "W" stands for "Water problem" and means lake and coastal areas will disturb the radio propagation. The Use_Code has one character and contains two codes which are "O" and "X". The "O" stands for "Operational frequency" and "X" stands for "Exercise frequency". The Unit_code has fourteen characters and gives the name of the unit that the radio equipment belongs to. Examples of the above information are in Appendix A.

b. The Frequency File

The frequency file contains all authorized frequencies for radio equipment and certain problems. This

database will help a signal officer by saving time and effort. This file has a data structure as follows:

F I C
Channel
Frequency
Prob_Code

All data elements were explained in Section B.1.a. above and examples are shown in Appendix A.

2. Program Structure

In the arena of structured systems design, there are two ways of measuring a program's structure or design quality. First is coupling which is the degree of interdependence between two modules. The objective is to minimize coupling, that is to make modules as independent as possible. Low coupling between modules indicates a well-partitioned system. [Ref.10:p.101] The second way is cohesion which is the relationship between activities within a single module. [Rer.10:p.117] Coupling and cohesion are interdependent since they are ways of measuring partitioning within a modular structure.

The prototype for the database model has a modular structure. It exhibits extensive parameter passing to support a low degree of coupling between highly cohesive modules. This is to facilitate program maintenance and future upgrade. There are four major modules: control, data

entry, editing, and report. Each module is briefly described by function below. Additional details are in the source code included as Appendix B.

The control module generates a full-screen menu which displays menu choices, user preferences, and appropriate submodules. Full-screen menus are used to select various functions and includes the MAINMENU which generates the opening menu and the submenu for editing files.

The data entry module displays lines of menu which allow the user to enter, accept, and check all information. The data structure file changes when a signal officer adds the new information and deletes old information.

The editing module provides a convenient mechanism to find a particular information record, to skip sequentially through the file in either direction, to make changes to the information stored in the file, to add new records to the file, and to delete and recall individual information records.

The report module produces a numerical order of frequency listing of all frequencies and their associated codes. These lists are produced by indexing the frequency file and are distributed and maintained by the staff at the Regiment unit for their convenience.

3. Software Selection

The software selected for implementing this model was the PC Apprentice dBASE-III PLUS database package by Ashton-Tate. Some reasons for these selections will be discussed below. The dBASE-III PLUS offers a high-level flexible database environment which can be changed with a minimal amount of effort. The transfer of many programs developed for microcomputers is directly related to the availability of programmers and analysts capable of maintaining the code. The popularity of dBASE-III PLUS ensures availability of maintenance programmers and tools well into the future.

4. Hardware Constraints

This model was designed to run on a IBM XT or AT compatible personal computer with a 20 MB hard disk drive and 720 KB three and half inch floppy diskette drive. This system provides sufficient storage to easily hold all frequencies of both AM and FM radio equipment. Furthermore, in a larger command, a greater storage capacity and/or more frequent backup of data from the frequency file may be necessary to ensure proper operation of the program.

C. IMPLEMENTATION

1. User Environment

This model will operate at the signal branch office at the Regiment unit level. On a daily basis, a subordinate will report to his commander via the signal officer for the status of frequency allocations. This list will be helpful to manage all frequencies at any time. It is expected that there will be no more than 48 frequency reports in a day.

The new frequency reports are entered and deleted by a subordinate for certain periods based on a schedule promulgated by the ROK Army Signal Headquarters, usually twice a month. The frequency file will be maintained as a reference file. For each period, the new information will be entered after being compared with the reference file.

2. Security Issues

Communication security is very important in any military activity. The information in this model is protected by military guards and is treated as critical information. The computer will be located in the signal branch office which is locked during non-business hours. This system will provide good security for the operation of the computer which means no one will gain access without the knowledge of the operating system and the specific procedure of this database model program. This system will also provide a greater degree of security for the individual communicator who could easily destroy

information by damaging floppy disks and/or computer systems in an emergency situation. The report lists are also marked with a classification term which reminds all individuals of the classification level of the information.

V. CONCLUSIONS

A. SUMMARY

Because of the Korean geography and political environment, the Republic of Korea presently has large armed forces and may require even larger and stronger armed forces in the future for national defense. An adequate communication system supports a critical role in the ROKA. Increasing the use of personal computers in the ROKA, and in particular, in the KACS, will enhance the capability of the ROKA. Personal computers will allow individual members of the ROKA to perform their duties in a more efficient and professional manner. As a final result, the ROKA will be stronger and therefore the ROK will have a better national defense.

This thesis has provided the concepts for application of the database model for frequency management for the ROKA Communication Branch, especially, at the regiment unit level. In the beginning of the study, current frequency management problems and requirements of the ROKA Communication System were mentioned. Next, the basic concepts of frequency management and theories between the international level and national level were discussed. In the last part of study, the proposed Frequency Management

Database Model(FMDM) was designed and developed for efficient operation at the ROKA regiment unit level.

This model produced a better frequency management operation for the ROKA Communication System and also provided an improved report format for special military activities of the ROKA. This model also provided an excellent means for ensuring that adequate security was maintained for the system. This security included both the hardware and the software. The FMDM can also be developed to include the higher unit levels of the ROKA.

B. RECOMMENDATIONS

When the FMDM is developed, the ROKA will be able to enhance the frequency management system in the communication area. Currently the ROKA needs a database model or program in the computer science field for frequency management. The ROKA has a good computer system and also a staff of programmers. They can support what this thesis states is required. This database model will increase the performance and efficiency of frequency management for the ROKA Communication System.

This model can be distributed by a diskette containing all the programs and instructions needed to carry out frequency management at each of the units.

APPENDIX A : OPERATIONAL INSTRUCTION

A. STARTUP

To install the Frequency Management Database Model(FMDM), copy the following files:

```
INDEX.EXE
FREQ.EXE
FREQ1.FRM
FREQ.FRE
FREQ.FMT
FREQ.PRG
FREQ.DBF
FREQ.FRM
FREQ.SCR
FREQ1.PRG
FREQ2.PRG
FREQRPT.PRG
FREQINX.PRG
FREQINX.EXE
README
```

This can normally be accomplished by placing the program diskette into "disk drive A:" and type "md freq" to create a new directory of FREQ at the "C>" prompt, and type "copy A:*.* C:\FREQ" to copy all files. Once all program files have been copied to the FREQ in hard drive, delete the FREQINX.PRG to erase the old FREQuency information, and then type "dbase" to execute the database program. Next type "do FREQ" to run the FREQ.

B. DATA STRUCTURE

Selecture Area: Database in Use: c:\FREQ\FREQ.dbf

Master Index File: FREQINX.exe Key: Frequency

Structure for Database: FREQ.dbf

Number of Data Records: 48

Data of Last Update : mm/dd/yy

Field	Field_Name	Type	Width	Decimal
1	FIC	Character	1	
2	Channel	Numeric	4	
3	Frequency	Numeric	6	2
4	Call_Sign	Character	10	
5	Prob_Code	Character	1	
6	Use_Code	Character	1	
7	Unit_Code	Character	14	
Total			37	

Field 1, 2, and 3 are fixed structures of the FMDM system which means these codes never change in name even if new frequencies are added to the system and the old frequencies are erased. These fields are the reference of the entire FMDM system. The remaining fields can change in structure when frequencies are added or erased in order to carry out the frequency management function using the database model.

C. FUNCTION DESCRIPTIONS

After startup of the FREQ program, any user can get the following menu in order to manage and maintain all of information that they require.

```
FREQUENCY   MANAGEMENT   MAIN   MENU

      1.   ADD       INFORMATION
      2.   MODIFY    INFORMATION
      3.   REMOVE    INFORMATION
      4.   REPORT    INFIRMATION
      0.   EXIT

                Select  [0]
```

Figure A.1. Main Menu

1. Add Information

To put new information into the program, a user selects the number [1] and adds the information which shows above the data structure of the FREQ program. It works like an edit and data entry module.

2. Modify Information

To correct the information, a user chooses the number [2] and modifies the information as required. It works like an edit module and allows the user to change a call-sign, prob-code, used-code, and unit-code, but will not change the FIC-code, frequency, and channel numbers.

3. Remove Information

To delete information, a user selects the number [3]. It also works as an edit module. It allows a user to delete a call-sign, prob-code, used-code, and unit-code, but will not delete the FIC-code, frequency, and channel numbers.

4. Report Information

To initiate a report command , a user can select the number [4] and create the reporting format lists which is indexed by the FREQINX.EXE program. More detailed explanation follows in Section D.

5. Exit

To terminate the database frequency management model, user chooses the number [0].

D. REPORT LIST

This FREQ database program provides a well-formed and indexed output reporting format by frequency, unit-code, call-sign, and channel. Most of these elements were explained in Chapter IV. This program also provides a screen menu to select the one report, of the four possible report formats, by using indexed lists as discussed below.

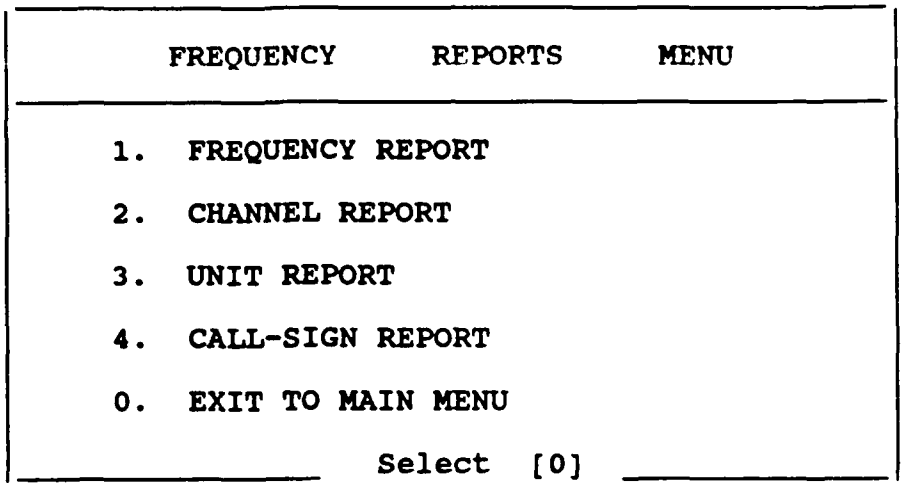

Figure A.2. Report Menu

1. Frequency Report

To select the formatted report in order of frequency, a user will choose the number [1]. This program generates the frequency order of output list.

2. Channel Report

To select the formatted report in order of channel number, a user will choose the number [2]. This program produces the channel number order of output list.

3. Unit Report

To select the formatted report in order of unit-code, a user will choose the number [3]. This program generates the unit alphabetical order of output list.

4. Call-Sign Report

To select the formatted report in order of call-sign code, a user will choose the number [4]. This program gives the call-sign alphabetical order of output list.

5. Exit to Main Menu

To exit to the main menu, a user will select the number [0].

6. Report List

For the Assigned_Unit, "command and com" means commanding network frequency for each unit, "R" stands for reserve operation frequency, "BN" stands for battalion, "reserve" stands for reserve force training network, and "receive" stands for receiving information from JCS or radio broadcasting. The first numbers are show the each unit orders and next numbers are show the order of command operation frequency. The exercise frequencies are listed after the units without any specified mission. Every report lists can contain the degree of classification term for that specific report list. An example of these reports are shown on the following pages.

Table 3. ROKA CHANNEL AND FREQUENCY TABLE (AM)

Page No. 1
01/31/89

ROKA CHANNEL & FREQUENCY TABLE

CHANNEL SET	FREQ	FIC	CALL SIGN	PROBE	CODE	USE	CODE	ASSIGNED UNIT
** FIC A								
169	2.69	A	SUMJINGANG	U		O		RESERVE 1 NIGHT
221	3.21	A	MORAE	U		O		COMMAND 1 NIGHT
259	3.59	A	SOPOONG	U		O		RESERVE 2 NIGHT
320	4.20	A	SONAMOO	U		O		COMMAND 1
428	5.28	A	GAEUL	U		O		RESERVE 2
514	6.14	A	HANRASAN	U		O		COMMAND 2 NIGHT
769	8.69	A	PUSAN	U		O		RESERVE 1
1576	16.76	A	HANGANG	U		O		COMMAND 2

Table 4. ROKA CHANNEL AND FREQUENCY TABLE (FM)

Page No. 2
01/31/89

ROKA CHANNEL & FREQUENCY TABLE

CHANNEL SET	FREQ	F I C	CALL SIGN	P R O B	C O D E	U S E	C O D E	ASSIGNED UNIT
** FIC F								
445	22.20	F	DOLO	U		X		2 BN 2
475	23.75	F	GAEUL	U		O		4 BN 2 COM R
505	25.25	F	SALGIB	T		X		REGIMENT 1
529	26.45	F	SOODO	T		X		4 BN 2
587	29.35	F	ORAK	U		O		COMMAND 1 M
229	31.45	F	HORANGEE	U		O		1 BN 1 COM M
675	33.75	F	ARIRANG	U		O		COMMAND 3 R
684	34.20	F	GANGMOOL	U		O		4 BN 1 COM M
783	39.15	F	NAMOO	U		O		3 BN 1 COM M
391	39.55	F	TONGIL	U		O		COMMAND 2 R
400	40.00	F	CHUSEOK	U		X		I BN 1
823	41.15	F	SINMOON	U		O		3 BN 2 COM R
859	42.95	F	GOOLBI	U		O		RESERVE COM 1 R
885	44.25	F	SHINBAL	U		O		1 BN 2 COM M
954	47.70	F	HANGOOK	U		O		2 BN 2 COM M
1043	52.15	F	BOOLGYO	U		O		RECEIVE 1
1103	55.15	F	JARA	U		O		4 BN 2 COM R
1126	56.30	F	GIBOONG	U		X		REGIMENT 3
1165	58.25	F	JANGNAL	U		X		4 BN 1
1215	60.75	F	GAMA	U		X		3 BN 2
1229	61.45	F	HANEUL	U		O		2 BN 1 COM R
1275	63.75	F	GUMI	U		O		RESERVE COM 2 R
1307	65.35	F	GONGCHAEK	U		O		4 BN 1 COM R
1326	66.30	F	SIGOL	U		O		1 BN 2 COM R
1419	70.95	F	CHOSUN	U		O		2 BN 2 COM R
1421	71.05	F	MOOLGUN	U		O		COMMAND 3 M
1435	71.75	F	JANGSA	U		X		RECEIVE 2
1441	72.05	F	SASEUM	U		X		3 BN 1
1459	72.95	F	SUNDO	U		X		REGIMENT 2
1474	73.70	F	SAEHAE	U		O		3 BN 1 COM R
1500	75.00	F	BADA	U		X		RESERVE COM 1 M
1515	75.75	F	BOOKHAN	H		X		RESERVE 1
1523	76.15	F	CHAMSAE	U		O		COMMAND 1 R
1621	81.05	F	BOODAE	U		O		COMMAND 2 M
1642	82.10	F	MOONSAN	U		X		2 BN 1
1661	83.05	F	HALOO	U		O		1 BN 1 COM R
1787	89.35	F	ONEUL	U		O		2 BN 1 COM M
1823	91.15	F	SIBANG	U		X		3 BN 2
1874	92.35	F	MIGOOK	U		O		3 BN 2 COM M

APPENDIX B : SOURCE PROGRAMS

A. FREQ.PRG

```
* Program..: FREQ.PRG
* Author...: Park, Nai Soo
* Date.....: 2/15/89
* Notes....: Main Menu generator
* Reserved.: sel

SET TALK OFF
SET BELL OFF
SET STATUS ON
SET ESCAPE OFF
SET CONFIRM ON
USE FREQ INDEX FREQ.NTX, FREQCHAN.NTX, FREQUNIT.NTX,
    FREQCC.NTX

DO WHILE .T.

   CLEAR
   @ 2, 4 TO 19,75 DOUBLE
   @ 3,12 SAY [F R E Q E N C Y  M A N A G E M E N T M A I N
              M E N U]
   @ 4,5 TO 4,74 DOUBLE
   @  7,26 SAY [1. ADD INFORMATION]
   @  9,26 SAY [2. MODIFY INFORMATION]
   @ 11,26 SAY [3. REMOVE INFORMATION]
   @ 13,26 SAY [4. REPORT INFORMATION]
   @ 15,26 SAY [0. EXIT]
   STORE 0 TO sel
   @ 19,33 SAY " Select [0]"
   @ 19,42 GET sel PICTURE "9" RANGE 0,5
   READ

   DO CASE
      CASE sel = 0
         SET BELL ON
         SET TALK ON
         CLEAR ALL
         RETURN

      CASE sel = 1
      *  ADD INFORMATION
         DO FREQ1
         USE

      CASE sel = 2
```

```
      *  MODIFY INFORMATION
         DO FREQ2
         SET CONFIRM ON

      CASE sel = 3
      *  REORGANIZE INDEXES
         DO FREQINX
         SET CONFIRM OFF

      CASE sel = 4
      *  DO PRINT REPORT
         DO FREQRPT
         SET CONFIRM OFF
         STORE ' ' TO wait_subst
         @ 23,0 SAY 'Press any key to continue...' GET
                    wait_subst
         READ
         SET CONFIRM ON
   ENDCASE

ENDDO T
RETURN
* EOF: FREQ.PRG
```

B2. FREQ1.PRG

```
* Program..: FREQ1.PRG
* Author...: Park, Nai Soo
* Date.....: 2/15/89
* Notes....: Add Frequency Data, called from Freq Main
Menu.
*         : This program is furnished to model a thesis
            application. It can be used as written and
            work rather well but, the code is simplified
            to show program concept and display a full
            system understanding, it could be optimized.
            'CLASSIFICATION' must be replaced with the
            proper classification statment prior to field
            use.

mMORE = 1

DO WHILE mMORE = 1
   m_KEY1 = '       '
   m_KEY2 = '     '
   m_CHAN = 0000
   m_FREQ = 000.00
   m_CC = SPACE(10)
   STORE ' ' TO m_PROB, m_FIC
   STORE .T. TO m_UCODE
   m_UNIT = SPACE(25)
   m_OOPS = 'A'

   CLEAR
   @  2,35 SAY 'CLASSIFICATION'
   @  6,10 SAY 'FIC    '         GET m_FIC    PICTURE '!'
   @  6,25 SAY 'Chanel    '     GET m_CHAN   PICTURE '9999';
               RANGE 0001, 1999
   @  6,50 SAY 'Frequency    '          GET m_FREQ  ;
               PICTURE '999.99' RANGE 1.00, 100.00
   @  9,10 SAY 'Call Code ' GET m_cc   PICTURE '!!!!!!!!!!'
   @  9,40 SAY 'Problem Indicator ' GET m_PROB  PICTURE '!'
   @ 12,10 SAY 'Use Code    '           GET m_UCODE
   @ 12,35 SAY 'Unit    '               GET m_UNIT ;
               PICTURE '!!!!!!!!!!!!!!!!!!!!!!!!!'
   @ 18,35 SAY 'CLASSIFICATION'
   READ SAVE

   IF m_FIC = 'A'.OR. m_FIC = 'F'
   ELSE
     CLEAR
     @ 10,10 SAY "FIC Must be entered"
     M_oops = 'B'
     WAIT
     LOOP
   ENDIF
```

```
 IF m_PROB = 'H' .OR. m_PROB = 'T' .OR. m_PROB = 'U' .OR.
    m_PROB = 'W'
 ELSE
   CLEAR
   @ 10,20 SAY ';Problem Code NOT Correct'
   WAIT
   LOOP
   m_OOPS = 'B'
 ENDIF

m_KEY1 = SUBSTR(m_FIC + STR(m_FREQ,4,2) + SPACE(7), 1, 7)
 SET INDEX TO FREQ.NTX
 FIND m_KEY1
 display memory
 wait

 IF FOUND()
    m_OOPS = 'B'
    CLEAR
    @ 10, 20 SAY 'FREQUENCY record already exists, Use
                  modify menu.'
    WAIT
 ENDIF

m_KEY2 = SUBSTR(m_FIC + STR(m_CHAN,4,0) + SPACE(5), 1, 5)
 SET INDEX TO FREQCHAN.NTX
 FIND m_KEY2
 IF FOUND()
    m_OOPS = 'B'
    CLEAR

    @ 10,12 SAY 'Channel is in USE, '
    @ 12,12 SAY 'Modify record found   '
    @ 13,12 SAY '       or'
    @ 14,12 SAY 'Reenter Channel in this record after
                 deleting'
    m_OOPS = 'B'
    WAIT
 ENDIF

 display memory
 wait

 IF m_OOPS = 'A'
    SET INDEX TO FREQ.NTX, FREQCHAN.NTX, FREQUNIT.NTX
    APPEND BLANK
    REPLACE    FIC    WITH   m_FIC
    REPLACE    CHAN   WITH   m_CHAN
    REPLACE    FREQ   WITH   m_FREQ
    REPLACE    CC     WITH   m_CC
    REPLACE    PROB   WITH   m_PROB
```

```
      REPLACE    UCODE  WITH   m_UCODE
      REPLACE    UNIT   WITH   m_UNIT
      CLEAR

      @  6, 20 SAY 'Frequency has been Sucessfully Added'
      @  7, 30 to  7, 40 DOUBLE
      @  9, 12 TO 17, 53 DOUBLE
      @ 10, 15 SAY 'Enter:      1 to Add more records'
      @ 12, 15 SAY '                  or'
      @ 14, 15 SAY '            2 to return to Menu   '
      @ 17, 20 SAY 'Enter Choice:  'GET mMORE PICTURE '9'

RANGE 1,2
      READ
   ENDIF
ENDDO
RETURN

* EOF: FREQ1.PRG
```

C. FREQ2.PRG

```
* Program..: FREQ2.PRG
* Author...: Park, Nai Soo
* Date.....: 2/15/89
* Notes....: Modify frequency records, called from freq
main
             menu, Modifys Frequency Data, but NOT, the FIC

m_MORE = 1

DO WHILE m_MORE = 1
   m_KEY1 = '       '
   m_KEY2 = '     '
   m_CHAN = 0000
   m_FREQ = 000.00
   m_CC = SPACE(10)
   STORE ' ' TO m_PROB, m_FIC
   STORE .T. TO m_UCODE
   m_UNIT = SPACE(25)
   CLEAR

   @  8,12 SAY 'Enter FIC    '   GET m_FIC   PICTURE '!'
   @ 10,12 SAY 'Enter frequqncy to modify   'GET m_FREQ ;
               PICTURE '999.99'   RANGE 0.05, 100.95
   @ 12,12 SAY '        -  OR - '
   @ 14,12 SAY 'Enter Channel TO modify    '  GET m_CHAN
               PICTURE '9999'
   READ

   IF m_FREQ > 000.05
      SET ORDER TO 1
     m_KEY1 = SUBSTR(m_FIC + STR(m_FREQ,4,2) + SPACE(7), 1,
              7)
      SEEK m_KEY1
   ELSE
      SET ORDER TO 2
     m_KEY2 = SUBSTR(m_FIC + STR(m_CHAN,4,0) + SPACE(5), 1,
              5)
      SEEK m_KEY2
   ENDIF

   display memory
   wait

   IF EOF()
      CLEAR
      @ 10,20 SAY 'Frequency OR Chanel NOT in database'
      @ 12,20 SAY '       Use the ADD option'
      WAIT
   ELSE
```

```
      CLEAR
      @  2,35 SAY 'CLASSIFICATION'
      @  6,10 SAY 'FIC    '
      @  6,15 SAY m_FIC
      @  6,25 SAY 'Channel    '
      @  6,34 SAY m_CHAN
      @  6,50 SAY 'Frequency    '
      @  6,61 SAY m_FREQ
      @  9,10 SAY 'Call Code    '          GET FREQ->CC ;
                  PICTURE '!!!!!!!!!!'
      @  9,40 SAY 'Problem Indicator    ' GET FREQ->PROB
                  PICTURE '!'
      @ 12,10 SAY 'Use Code    '           GET FREQ->UCODE
      @ 12,35 SAY 'Unit    '             GET FREQ->UNIT ;
                  PICTURE '!!!!!!!!!!!!!!!!!!!!!!!!!'
      @ 15,10 SAY 'FIC, Frequency and Channel are not
                  MODIFIED'
      @ 18,35 SAY 'CLASSIFICATION'

      READ
      m_CC = FREQ->CC
      m_PROB = FREQ->PROB
      m_UCODE = FREQ->UCODE
      m_UNIT = FREQ->UNIT

      REPLACE FIC   WITH m_FIC
      REPLACE CHAN  WITH m_CHAN
      REPLACE FREQ  WITH m_FREQ
      REPLACE CC WITH m_CC
      REPLACE PROB WITH m_PROB
      REPLACE UCODE WITH m_UCODE
      REPLACE UNIT WITH m_UNIT
   ENDIF

   CLEAR GETS
   CLEAR

   @10,15 SAY 'ENTER:  1 to modify another record'
   @12,15 SAY '                or'
   @14,15 SAY '        2 to return to Menu    '
   @15,32 GET m_MORE PICTURE '9' RANGE 1,2
   READ
ENDDO
RETURN

* EOF: FREQ2.PRG
```

D. FREQINX.PRG

```
* Program   : FREQINX.PRG
* Author    : Park, Nai Soo
* Date      : 2/15/89
* Notes     : To list in order of frequency, unit, or
              call-sign, this program create a indexed
              output list.

SET TALK ON
!DEL FREQ*.NTX

USE FREQ
INDEX ON SUBSTR(FIC + STR(FREQ,4,2) + SPACE(7), 1, 7) TO
FREQ.NTX
INDEX ON SUBSTR(FIC + STR(CHAN,4,0) + SPACE(5), 1, 5) TO
FREQCHAN.NTX
INDEX ON UNIT TO FREQUNIT.NTX
INDEX ON CC TO FREQCC.NTX

SET TALK OFF
RETURN

* EOF FREQINX.PRG
```

E. FREQRPT.PRG

```
* Program..: FREQRPT.PRPG
* Author...: Park, Nai Soo
* Date.....: 2/15/89
* Reserved.: select number

DO WHILE .T.
   CLEAR
   @  2, 5 TO 18,75 DOUBLE
   @  3,18 SAY [F R E Q U E N C Y   R E P O R T S  M E N U]
   @  4,6 TO 4,74 DOUBLE
   @  7,30 SAY [1.  FREQUENCY REOPRT]
   @  9,30 SAY [2.  CHANEL REPORT]
   @ 11,30 SAY [3.  UNIT REPORT]
   @ 13,30 SAY [4.  CALL CODE REPORT]
   @ 15,30 SAY [0.  EXIT]
   STORE 0 TO casenum
   @ 18,33 SAY " select     "
   @ 18,42 GET casenum PICTURE "9" RANGE 0,4
   READ

   DO CASE
      CASE casenum = 0
         SET ORDER TO 1
         RETURN

      CASE casenum = 1
         SET ORDER TO 1
         REPORT FORM FREQ TO PRINT

      CASE casenum = 2
         SET ORDER TO 2
         REPORT FORM FREQ1 TO PRINT

      CASE casenum = 3
         SET ORDER TO 3
         REPORT FORM FREQ1 TO PRINT

      CASE casenum = 4
         SET ORDER TO 4
         REPORT FORM FREQ1 TO PRINT

   ENDCASE
ENDDO T
RETURN

* EOF: FREQRPT.PRG
```

APPENDIX C : LIST OF ACRONYMS

AM	Amplitude Modulation
BN	Battalion
CCIR	International Radio Consultative Committee
CCITT	International Telegraph and Telephone Consultative Committee
CEOI	Communications Electronics Operation Instructions
COM	Command Network
dbase	database
FIC	Frequency Identification Code
FM	Frequency Modulation
FMDM	Frequency Management Database Model
Hz	Hertz
IFRB	International Frequency Registration Board
ITU	International Telecommunication Union
JCS	Joint Chiefs of Staff
KACS	Korean Army Communication System
KB	Kilo Byte
MB	Mega Byte
md	make directory
MHz	Mega Hertz
MOC	Ministry of Communications
MOND	Ministry of National Defense

PC	Personal Computer
R	Reserve Commanding Frequency
ROK	Republic of Korea
ROKA	Republic of Korea Army
3NF	Third Normal Form
UN	United Nations
UNF	United Nations Forces
USA	United States Army
USF	United States Forces
WARC	World Administrative Radio Conference
WATTC	World Administrative Telegraph and Telephone Conference

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